

Description of *Brachistosternus pehuenche* sp. nov. (Scorpiones, Bothriuridae), a new scorpion species from the upper Maule Valley, in the southern Chilean Andes

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Abstract

Brachistosternus pehuenche sp. nov. (Scorpiones, Bothriuridae) is described from the Mauline Andean forests of the northern Chilean Patagonia, located within the upper basin of the Maule Valley. Its unique geography and the discovery of this partial isolation, as a result of the surrounding higher altitudes, support the role of this valley as a biodiversity hotspot, fostering a variety of endemic epigeal arthropods. The discovery of this third endemic scorpion species highlights the area's ecological uniqueness. The species is most similar to *Brachistosternus negrei*, a species found in the southern Chilean forests, but distinct morphological traits, such as pigmentation patterns and metasomal structures, clearly separate the two. This study underscores the ecological value of the Maule Valley, which, despite its high endemism, remains unprotected and is subject to significant anthropogenic pressures, including agriculture, hydropower projects, and international transit routes. The need for conservation initiatives in this region is critical to preserve its exceptional biodiversity. This work not only adds to the taxonomy of *Brachistosternus* but also raises fundamental questions about the processes driving endemism in the Andes and the broader implications for the conservation of montane ecosystems.

Key Words

Area of endemism, Bothriuridae, Chile, Mauline woods, new species, Scorpiones

Introduction

Chile harbors a remarkably high diversity of epigeal arthropods. Due to its particular geography, characterized by an extreme latitudinal gradient crossed by numerous transversal rivers and mountain chains, this country has

several areas of endemism, each with their own arthropod communities (Ojanguren-Affilastro et al. 2007a, b; Ojanguren-Affilastro and Pizarro-Araya 2014; Pizarro-Araya and Alfaro 2018; Pizarro-Araya et al. 2021, 2023). However, our current knowledge of the actual biodiversity of the country is still very poor, with most areas of Chile

poorly sampled and with several invertebrate groups systematics neglected due to a lack of specialists.

The Andean Maule forests of the upper basin of the Maule Valley (Fig. 1), in southern Chile, have revealed the presence of several potentially endemic species (Corbalán et al. 2010; Correa et al. 2018; Correa et al. 2020; Ojanguren-Affilastro et al. 2020, 2024). Its partial isolation from neighboring adjacent valleys as a result of higher altitudes explains the presence of its particular isolated community. In recent years, we have conducted several collection campaigns in this valley and its neighboring areas, where we have collected a considerable number of undescribed epigeal arthropods. Among them, scorpions appear as a highly diversified group in the area. In previous contributions, we described two new species of the genus *Urophonius* Pocock, 1893, that are potentially endemic to this area: (a) *Urophonius pehuenche* Ojanguren-Affilastro & Pizarro-Araya, 2020, which is active in the winter (Ojanguren-Affilastro et al. 2020), and (b) *Urophonius trewanke* Ojanguren-Affilastro, Alfaro, Ramírez, Camousseigt-Montolivo & Pizarro-Araya, 2024, which is active in the summer (Ojanguren-Affilastro et al. 2024). In both contributions, we also documented in this same area the presence of a third undescribed scorpion species belonging to the genus *Brachistosternus* Pocock, 1893, which is herein described as *Brachistosternus pehuenche* sp. nov.

The genus *Brachistosternus* is highly diversified in arid and semiarid areas of southern South America and

is the dominant scorpion group in these extremely harsh environments (Ojanguren-Affilastro and Ramírez 2009; Ojanguren-Affilastro et al. 2016, 2018). By contrast, only a handful of species of this genus occur in areas of woods (Ceccarelli et al. 2016). In Chile, only *Brachistosternus chilensis* Kraepelin 1911 and *Brachistosternus negrei* Cekalovic 1975 can be found in central and south-central dry woods, respectively (Ojanguren-Affilastro 2005; Ojanguren-Affilastro and Scioscia 2007). *Brachistosternus pehuenche* is the third Chilean *Brachistosternus* species occurring in this kind of environment and the third potentially endemic scorpion species of the upper Maule Valley.

Despite the remarkable biological diversity of the study area and its immense potential as a hotspot for endemic species, no formal actions have been taken to establish protected areas to safeguard this unique environment. The upper Maule Valley, with its distinctive geography and ecology, harbors a rich array of species that appear to be restricted to this region, underscoring its importance as a critical area for conservation. However, the lack of protection leaves this ecosystem vulnerable to escalating anthropogenic threats, including land-use changes, infrastructure development, and resource exploitation.

In this contribution, we present the formal description of *Brachistosternus pehuenche* sp. nov., a scorpion species likely endemic to the upper Maule Valley. This finding reinforces the hypothesis that the region constitutes an area of endemism for epigeal arthropods, driven by its partial isolation and unique environmental conditions. Furthermore, we emphasize the urgent need for conservation actions, including the establishment of protected areas, to ensure the preservation of this exceptional ecosystem and its endemic biota, which are at an increased risk from human activities.

Methods

The specimens examined are deposited in the following collections: Museo Argentino de Ciencias Naturales “Bernardino Rivadavia,” Buenos Aires, Argentina (MACN-Ar, Martín J. Ramírez); Museo Nacional de Historia Natural, Santiago, Chile (MNHN, Mario Elgueta Donoso); Museo de Zoología de la Universidad de Concepción, Concepción, Chile (MZUC-UCCC, Laura Tavera Martínez); Laboratorio de Entomología Ecológica, Universidad de La Serena, La Serena, Chile (LEULS, Jaime Pizarro-Araya).

All the new material reported here was collected by the authors; most specimens were collected at night using UV detection. Some specimens were also collected in the daytime under logs or stones. All measurements, taken using an ocular micrometer, are presented in millimeters (mm). The descriptive terminology follows Mattoni and Acosta (2005) and Ojanguren-Affilastro and Ramírez (2009) for hemispermatoophores; names of structures according to Monod et al. (2017) are also included between brackets when comparable; Loria and Prendini (2014)

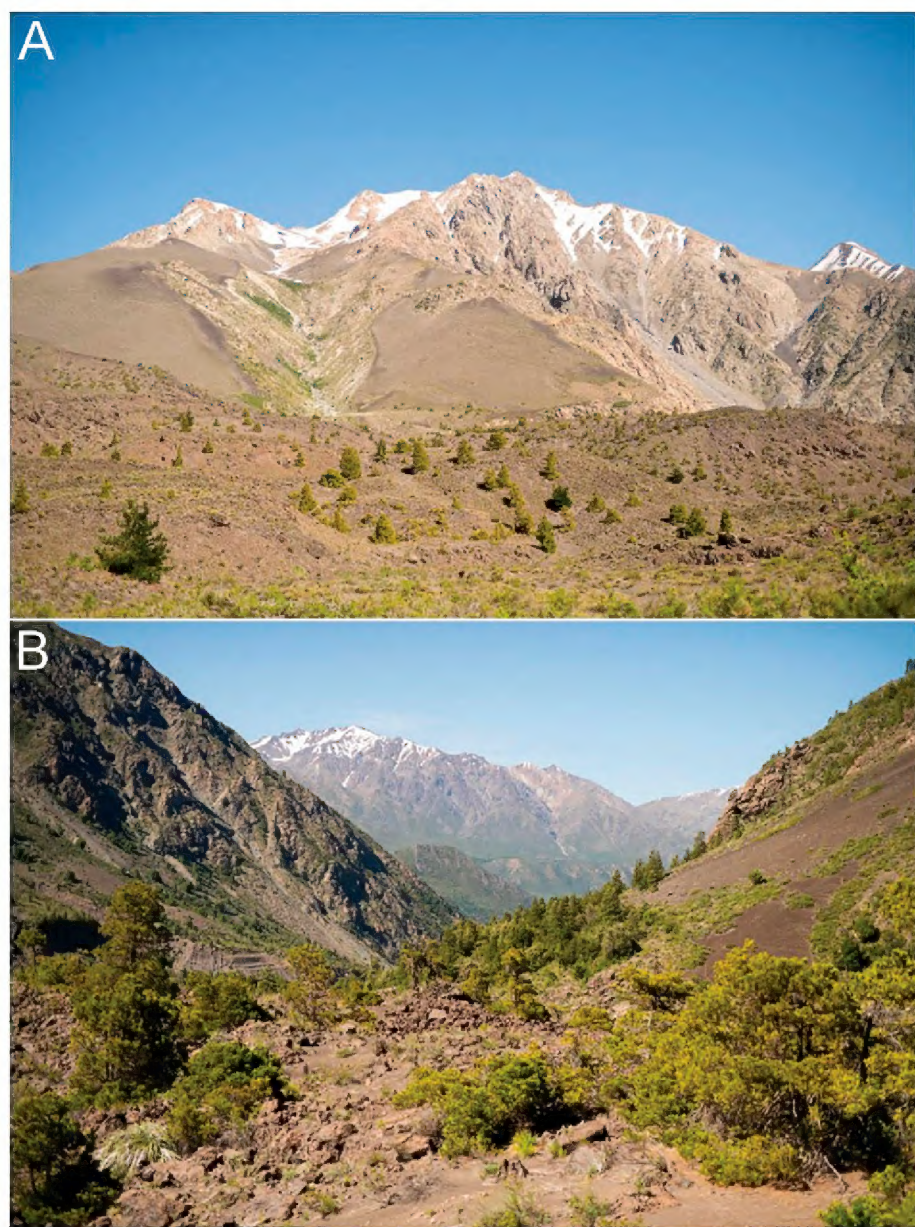


Figure 1. A, B. Type locality of *Brachistosternus pehuenche* sp. nov. (Scorpiones; Bothriuridae), woods at Fundo La Escuadra, Maule Valley, Maule Region, Chile.

for the lateral ocelli; Vachon (1952) for cheliceral dentition; Vachon (1973) for trichobothria; Francke (1977) for metasomal carinae, abbreviated as follows: **DL**: dorsolateral, **LIM**: lateral infra-median, **LSM**: lateral suprmedian, **LM**: lateral median, **VSM**: ventral submedian, **VL**: ventrolateral, **VM**: ventro-median; and Prendini (2000) for pedipalp carinae, abbreviated as follows: **DI**: dorsal internal, **DE**: dorsal external, **VI**: ventral internal, **VE**: ventral external, **D**: digital, **E**: external, **IM**: interno-median, **EM**: externo-median, **V**: ventral, **VM**: ventral median, **DM**: dorsal marginal, **DS**: dorsal secondary. The illustrations were produced with a Leica M165C stereomicroscope and a camera lucida. The digital images of the pigmentation pattern and habitus were taken under visible light, and the images of the external morphology were taken under UV light, using a digital camera (Leica DFC290) attached to a stereomicroscope (Leica M165C), and the focal planes were combined with Helicon Focus 3.10.3 (<http://helicon.com.usa/heliconfocus/>). The point locality records were georeferenced in the field with portable Global Positioning System devices (Garmin® Etrex Vista and Etrex Vista C). The distribution map was generated using <https://www.simplemappr.net/>.

Results

Systematics

Brachistosternus pehuenche sp. nov.

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Figs 1–3, 4A–D, 5A, B, D–E, 6, 7, Table 1

Type material. CHILE, Maule Region (VII), Maule Valley, Fundo La Escudra: **Holotype** ♂ (MNHN 8651), Site 4, Open woods of *Austrocedrus chilensis* (35°44'21.8"S, 70°46'43.7"W), 1292 m a.s.l., 07–10/XII/2022, Pizarro-Araya, Alfaro & Calderón coll. **Paratypes**: Armerillo (Cabaña) manual (35°42'13.26"S, 71°6'22.16"W), 750 m a.s.l., 16–19/I/2018, Pizarro-Araya, Alfaro & Calderón coll. 1 ♀ (MACN) • Fundo La Escudra, Site 2, L Invernada lagoon (35°43'16.1"S, 70°47'04.9"W), 1260 m a.s.l., 14–17/X/2022, Pizarro-Araya, Alfaro & Calderón coll. 2 ♀, 4 ♂ (MACN) • Fundo La Escudra, Site 2, Herbazal Invernada Lagoon (35°43'16.1"S, 70°47'04.9"W), 1260 m a.s.l., 07–10/XII/2022, Pizarro-Araya, Alfaro & Calderón coll. 8 ♀, 3 ♂, 5 juveniles (LEULS), 5 ♀, 1 ♂, 1 juvenile (MNHN) 4 ♀, ♂, 1 juvenile (MZUC-UCCC) • Fundo La Escudra, Site 4, Open woods of *Austrocedrus chilensis* (35°44'21.8"S, 70°46'43.7"W), 1292 m a.s.l., 07–10/XII/2022, Pizarro-Araya, Alfaro & Calderón coll. 3 ♀, 1 ♂, 3 juveniles (LEULS), 5 ♀, 2 juveniles (MNHN), 3 ♀ (MZUC-UCCC) • La Escudra, Site 4, Open woods of *Austrocedrus chilensis* (35°44'21.8"S, 70°46'43.7"W), 1292 m a.s.l., 07–10/XII/2023, Pizarro-Araya, Alfaro & Calderón coll. 5 ♀, 9 ♂ (MACN) • La Escudra, Site 5, Hornitos volcano (35°45'14.7"S, 70°47'32.3"W), 1154 m a.s.l., 07–10/XII/2023, Pizarro-

Araya, Alfaro & Calderón coll. 1 ♀, 2 ♂ (MACN) • La Escudra, Site 6, Woods of *Quillaja saponaria* and *Cryptocarya alba*, (35°46'04.1"S, 70°47'45.6"W), 1020 m a.s.l., 07–10/XII/2023, Pizarro-Araya, Alfaro & Calderón coll. 2 ♀, 2 ♂ (MACN) • Fundo La Escudra, Site 10, Bocatoma Ojos de Agua (35°46'06.1"S, 70°47'44.4"W), 1009 m a.s.l., 14–17/X/2022, Pizarro-Araya, Alfaro & Calderón coll. 3 ♀, 1 ♂ (LEULS) • Los Cóndores valley, Paso Pehuenche, Proy. Los Cóndores, Polig. B-Y10 (35°58'25.22"S, 70°33'35.62"W), 1182 m a.s.l., 16–19/I/2018, Pizarro-Araya, Alfaro & Calderón coll. 1 ♀, 2 ♂, 1 juvenile (MACN) • Paso Pehuenche (35°49'32.362"S, 70°45'0.849"W), 1000 m a.s.l., 18/I/2018, Ramírez, Pérez-González, Porto & Ojanguren-Affilastro coll. 2 ♂ (MACN) • Paso Pehuenche (35°51'31.968"S, 70°41'0.275"W), 1200–1250 m a.s.l., 18/I/2018, Ramírez, Pérez-González, Porto & Ojanguren-Affilastro coll. 6 ♀, 9 ♂, 9 juveniles (MACN) • Paso Pehuenche (35°57'31.608"S, 70°34'22.871"W), 1800–1900 m a.s.l., 18/I/2018, Ramírez, Pérez-González, Porto & Ojanguren-Affilastro coll. 13 ♀, 22 ♂, 21 juveniles (MACN) • Paso Pehuenche (35°54'21.97"S, 70°38'30.64"W) 1300 m a.s.l., 29/XI/2021, Pizarro-Araya, Alfaro & Ojanguren-Affilastro coll. 2 ♀, 5 ♂, 5 juveniles (MACN) • Paso Pehuenche (35°55'10.61"S, 70°37'27.12"W) 1400 m a.s.l., 18/I/2021, Pizarro-Araya, Alfaro & Ojanguren-Affilastro coll. 9 ♀, 3 ♂, 2 juveniles (MACN) • Paso Pehuenche (35°56'52.92"S, 70°35'57.97"W) 1700 m a.s.l., 18/I/2021, Pizarro-Araya, Alfaro & Ojanguren-Affilastro coll. 1 ♀, 2 ♂ (MACN) • Los Cóndores valley, Paso Pehuenche, Proy. Los Cóndores, Polig. B-Y10 (35°58'25.22"S, 70°33'35.62"W), 1182 m a.s.l., 16–19/I/2018, Pizarro-Araya, Alfaro & Calderón coll. 1 ♀, 2 ♂, 1 juvenile (MACN) • Los Cóndores valley, Paso Pehuenche, Proy. Los Cóndores, Polig. B-Y10 S1 R2 (35°51'21.72"S, 70°41'0.10"W), 1184 m a.s.l., 16–19/I/2018, Pizarro-Araya, Alfaro & Calderón coll. 1 juvenil (MACN) • Los Cóndores valley, Paso Pehuenche, Proy. Los Cóndores, Polig. B-Y10 S1 R1 (35°51'25.08"S, 70°40'59.61"W), 1190 m a.s.l., 16–19/I/2018, Pizarro-Araya, Alfaro & Calderón coll. 1 juvenile (MACN) • Los Cóndores valley, Paso Pehuenche, Proy. Los Cóndores, Polig. B-Y10 S1 R3, (35°51'24.02"S, 70°40'55.40"W), 1191 m a.s.l., 16–19/I/2018, Pizarro-Araya, Alfaro & Calderón coll. 1 juvenil (MACN) • Los Cóndores valley, Paso Pehuenche, Proy. Los Cóndores, Polig. B-Y9, S2 R2 (35°52'16.13"S, 70°40'52.62"W), 1233 m a.s.l., 16–19/I/2018, Pizarro-Araya, Alfaro & Calderón coll. 1 juvenile (MACN) • Valle de los Cóndores, Paso Pehuenche, Proy. Los Cóndores, Polig. IF Las Luces, S7 R2 (35°55'26.16"S, 70°37'9.75"W), 1449 m a.s.l., 16–19/I/2018, Pizarro-Araya, Alfaro & Calderón coll. 1 juvenile (MACN).

Etymology. The specific epithet “*pehuenche*” is a noun in apposition referring to the Pehuenche International Pass between Argentina and Chile, in the northern Patagonia, where this and other endemic scorpion species have been collected. Pehuenche is also the name of the indigenous people of this area, belonging to the Mapuche cultural group.

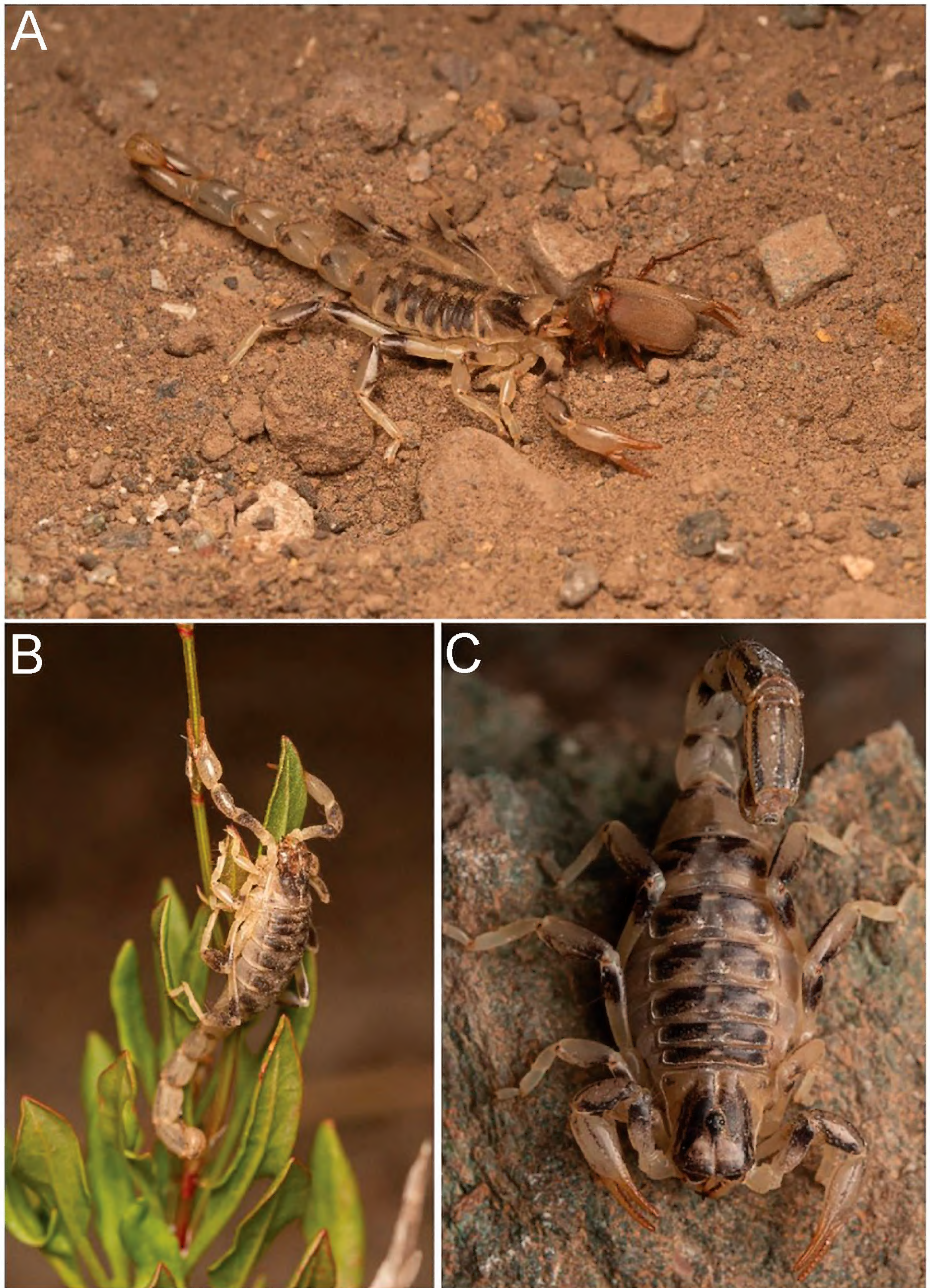


Figure 2. A–C. *Brachistosternus pehuenche* sp. nov. (Scorpiones; Bothriuridae). **A.** Preying on an adult of *Athlia rustica* (Coleoptera: Scarabaeidae); **B.** Climbing on branches of *Lobelia* sp. (Campanulaceae) in a hunting position for flying insects; **C.** Male, living specimen.

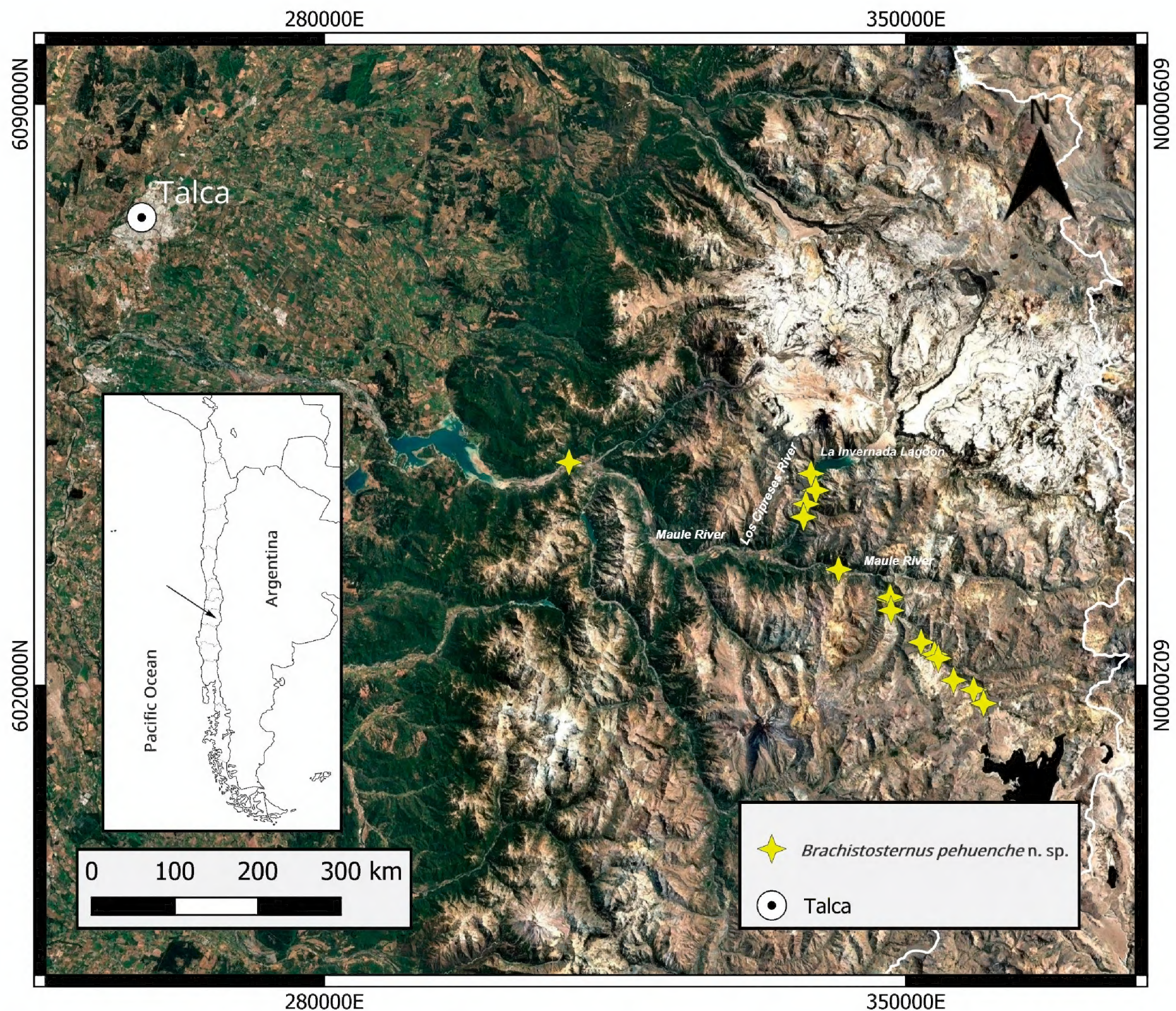


Figure 3. Distribution map of *Brachistosternus pehuenche* sp. nov. (Scorpiones; Bothriuridae), showing the collecting sites along the Cipreses River and the Maule River, Maule Region, Chile.

Diagnosis. *Brachistosternus pehuenche* sp. nov. is most similar to *B. negrei*, which is the only *Brachistosternus* species occurring in nearby areas of the south-central Chilean woods. Both species can be easily distinguished by several morphological characters. *Brachistosternus pehuenche*, on one hand, has tergites that bear two lateral spots, with pigment occupying most of the posterior lateral margins and leaving a median unpigmented stripe (Figs 4A, C, 5A); *B. negrei*, on the other hand, has five spots on each segment, one antero-median, two lateral, and two postero-submedian, in some cases connected by faint reticulate pigment (Fig. 5E). The metasomal segments I–IV of *B. pehuenche* bear two VL narrow stripes and a VM wide stripe (the VM stripe can be very faint or absent in segments I–III) (Fig. 5B), whereas in *B. negrei* there are two VL stripes and two VSM stripes (VSM stripes can be faint or absent in segments I–III) (Fig. 5F). The paired dorsal glands of metasomal segment V of males, or Androvestigia, are medium-sized in *B. pehuenche*, occupying from a third to almost the entire posterior half of the segment (Fig. 5C), whereas in *B. negrei* these glands

are small, occupying between 10 to 25 percent of the dorsal surface of the segment (Fig. 5G). Metasomal segment V is more granular ventrally in *B. pehuenche* than in *B. negrei*, with some granules even forming a slight ventro-median carinae in the former (Fig. 5D), whereas in *B. negrei* there is no VM carina at all, and ventral granules are more sparse and smaller (Fig. 5H).

Description. Based on the male holotype (MNHN) and the paratypes (MACN, LEULS). Total length, males: 50–58 mm ($N = 10$; mean = 53.90 mm); females: 50–58 mm ($N = 10$; mean = 53.00 mm). (Measurements of a male and a female paratype are in Table 1).

Color: Base color yellowish, with dark brown pigmentation pattern in pedipalps, carapace, tergites, metasoma, and legs; the remaining, yellowish without dark spots (Fig. 4A–C). Chelicerae with faint pigmentation on external surface of movable finger; manus with dense reticulate pigment dorsally and densely pigmented near the base of the fixed finger. Carapace, with a heavily pigmented anterior triangular area from the postocular furrow to the lateral ocelli, leaving a slightly less pigmented area anterior

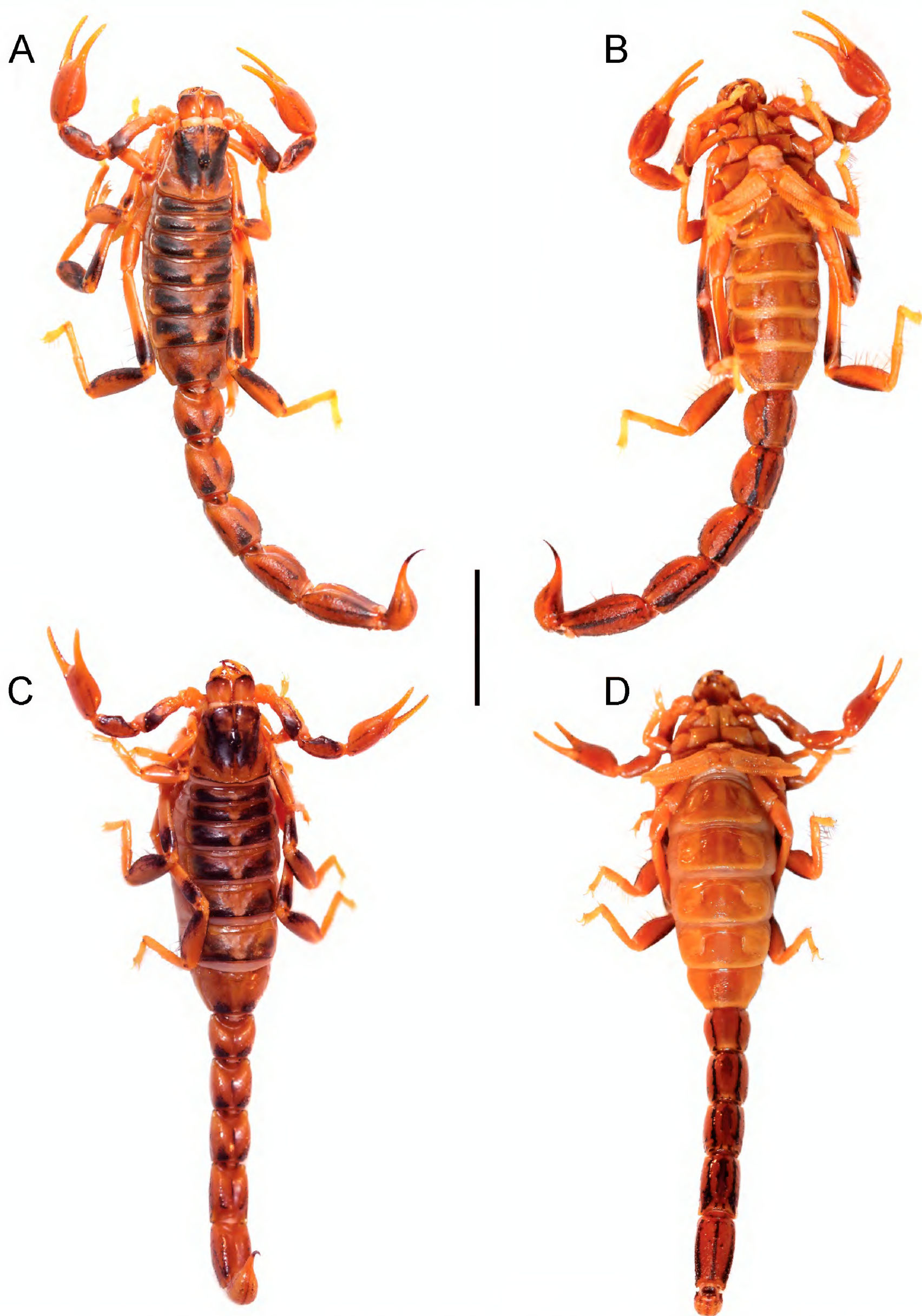


Figure 4. A–D. *Brachistosternus pehuenche* sp. nov., habitus. **A.** Male, dorsal aspect; **B.** Male, ventral aspect; **C.** Female, dorsal aspect; **D.** Female, ventral aspect. Scale bar: 1 cm.

to the ocular tubercle (in some specimens, as the type material, it can be densely pigmented, but in others it is unpigmented); median ocular tubercle dark brown; with two small posterolateral dark spots, leaving a posterior median

unpigmented area. Pedipalps, coxae, and trochanter unpigmented; femur, dorsally heavily pigmented in the distal third, ventro-posterior margin with a faint stripe, the rest unpigmented. Patella, with a wide dorso-internal stripe,

dorso-external margin with reticulate pigment, and the rest unpigmented. Chela with six dark stripes along DI, DM, DS, D, E, and V carinae; the external stripes are in some cases connected by a faint reticulate pattern. Legs: coxae and trochanter unpigmented; femur pigmented in its apical third, near articulation with patella; patella pigmented on the ventro-external and dorso-internal margins; tibia, basitarsi, and telotarsi unpigmented. Tergites I–VI heavily pigmented, each with two subtriangular lateral spots leaving an unpigmented median stripe (Fig. 5A); in some specimens, there is a median faint small anterior spot; tergite VII with the lateral spots limited to the posterior third of the segment. Sternites, sternum, genital opercula, and pectines unpigmented. Metasomal segment I: dorsal surface with two posterolateral dark spots and an anterior median thin small faint spot, lateral margins unpigmented; ventral surface with three stripes; two thin, well-developed VL and a faint wide VM; in less pigmented specimens the VM stripe can be absent. Metasomal segment II–III similar to segment I (Fig. 5B), but the dorsal median spot is more extended and marked, the lateral margins bear tiny spots near the base of LSM and LIM setae, and the VM stripe is usually more densely marked (yet it can be absent in some specimens). Metasomal segment IV similar to segment III, but the lateral margins have a single LSM stripe along the segment, and the VSM stripe is always present and well-marked. Metasomal segment V dorsal surface with faint pigment on each side, Androvestigia of males light yellow, with thin DL stripes along the whole segment, widening distally; lateral margin with thin complete LSM stripe, ventral surface with two VL stripes and a VM stripe along the whole segment, all of them being thin and well-marked. Telson, vesicle ventrally with three faint longitudinal stripes, lateral margins with a thin stripe, dorsally with dorso-lateral spots; glands of males poorly marked with tegument with similar color to the rest of the dorsal surface; aculeus basally unpigmented, apex dark brown.

Chelicerae: Anterior margin of movable finger curved, with two small subdistal teeth.

Pedipalps: Femur (Fig. 7G) with DI, DE, and VI carinae granular, extending the entire length of the segment in males, less marked in females; DE carina with two macrosetae, DI carina with one median macroseta, VE carina absent; anterior margin with some scattered coarse granules and three macrosetae; rest of the intercarinal surfaces smooth. Patella with DI and VI carinae slightly granular (Fig. 7F), more so in males, extending the entire length of segment; rest of the segment smooth. Chela manus medium-sized (Fig. 7A–E), slightly more robust in males, length/width ratio, males 3.30–3.75 ($N = 10$; mean = 3.49), females 3.54–4.23 ($N = 10$; mean = 3.86), length/height ratio males 2.70–3.00 ($N = 10$; mean = 2.88), females 2.97–3.18 ($N = 10$; mean = 3.08); with a blunt but well-developed V accessory carina, more conspicuous in males, internal surface with a pronounced, subtriangular projection near the articulation of the movable finger in males (Fig. 7B, C, E), absent in females (Fig. 7A); fingers elongated, with a median row of denticles, and with seven

to nine pairs of accessory denticles. Trichobothrial pattern neobothriotaxic major Type C (Fig. 7A–G), with one accessory trichobothrium in V series of chela; femur with 3 trichobothria (*d*, *i*, *e*), one macroseta (M1) associated with *d* and *i*; patella, with 19 trichobothria (2 *d*, *i*, 3 *et*, *est*, 2 *em*, 2 *esb*, 5 *eb*, 3 *V*); chela with 27 trichobothria (*Dt*, *Db*, 5 *Et*, *Est*, *Esb*, 3 *Eb*, *dt*, *dst*, *dsb*, *db*, *et*, *est*, *esb*, *eb*, *ib*, *it*, 5 *V*), with *Esb* forming triangle with *Eb*2 and *Eb*3.

Carapace: Anterior margin convex, with six setae and a well-developed median bulge. Surface slightly granular in the median area, almost smooth in females; lateral and posterior surfaces more densely granular. Anterior longitudinal sulcus, posterior longitudinal sulcus, and lateral sulci very well developed. Median ocular tubercle well developed, placed slightly in front of the middle of the carapace, smooth surface except for its posterior margin, which is slightly granular and bears two setae, one behind each eye; inter-ocular sulcus only barely visible in the posterior margin, median ocelli medium large, ca. two diameters apart, and aiming laterally. Lateral ocelli pattern type 3A, with three small, similarly sized, lateral ocelli on each side of carapace; anterior and posterior situated in the same horizontal axis, median ocellus situated slightly below them; posterior ocellus situated one diameter apart from anterior and median ocelli.

Legs: Surfaces smooth. Basitarsi, each with two well-developed pedal spurs, being the internal one about 30 percent smaller compared to the external one in legs I and II, and slightly smaller in legs III and IV. Telotarsi ventrolaterally compressed, dorsally with a row of setae, ventrally each with an incomplete ventro-median row of poorly developed hyaline setae, and paired rows of ventro-submedian setae; telotarsus III with the following counts of setae: dorsal setae: 7–9 ($N = 15$; median = 19); ventrointernal setae: 4–6 ($N = 15$; median = 6); ventroexternal setae: 2–5 ($N = 15$; median = 3). Ungues slightly curved, external unguis being about 30 percent smaller compared to the internal in legs I and II, and being equal in size in legs III and IV. Pseudoniquium and distal projection well developed.

Pectines: Well developed. Tooth count, males: 29–33 ($N = 10$; median = 33); females: 28–32 ($N = 10$; median = 31).

Sternum: With two small subtriangular lateral lobes, each with a macroseta clearly thicker and blunter than the remaining ventral macrosetae (Ojanguren-Affilaastro et al. 2018).

Genital opercula: Sclerites subtriangular, with a posterior lobe.

Tergites: I–VI, with two anterior dorso-submedian setae; surfaces, smooth in females, barely granular in the postero-lateral margins in males; VII granular in the posterior half, with paired lateral carinae in posterior half of segment, and paired submedian carinae restricted to the posterior margin, with two barely visible sub-median bulges in the posterior median third of the segment.

Sternites: III–VI surface densely granular in posterior half in males, smooth in females, with medium-sized elliptical spiracles and small and shallow ventro-submedian pits; VII granular in males, smooth in females.

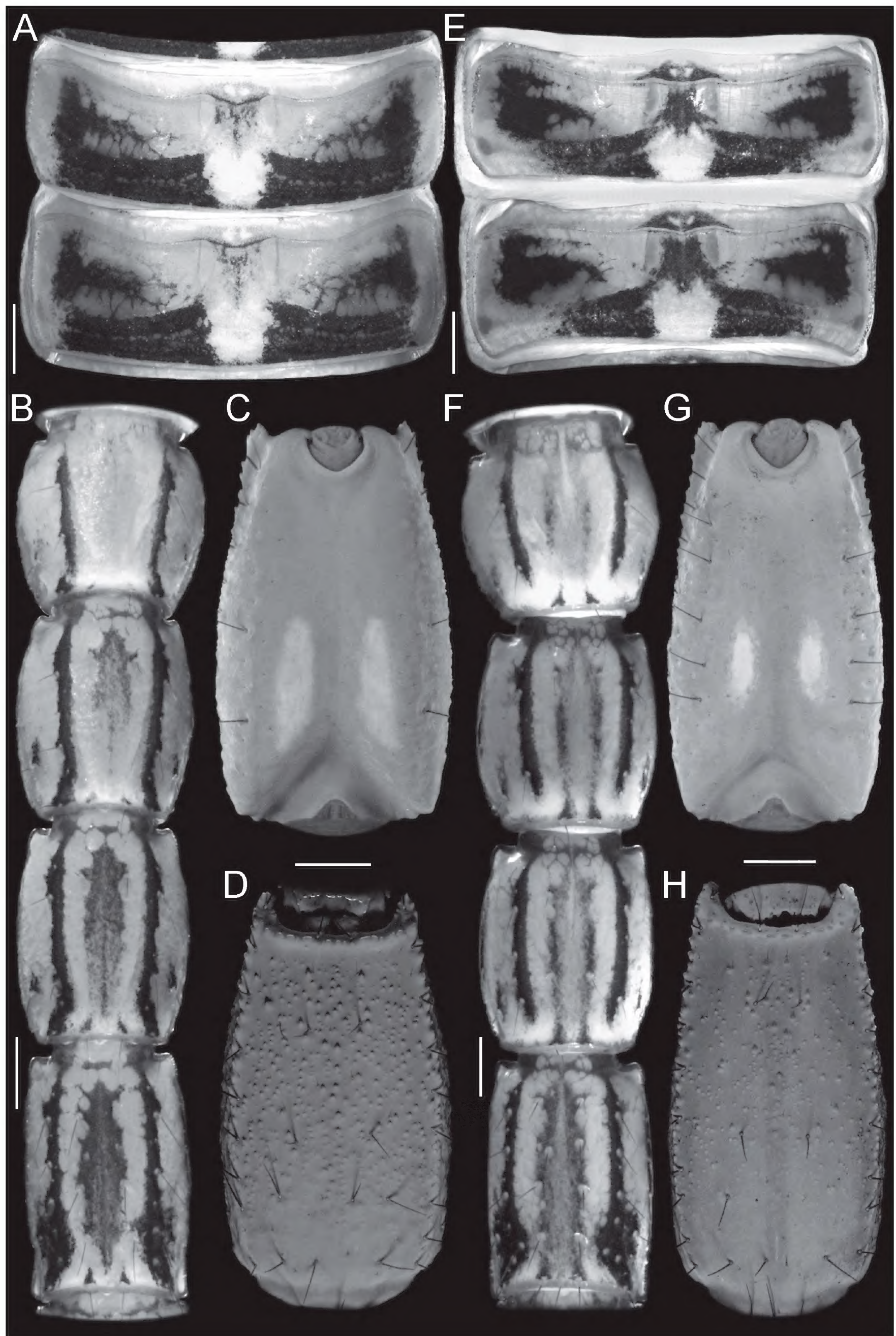


Figure 5. A–D. *Brachistosternus pehuenche* sp. nov. A. Tergites IV and V, pigment pattern; B. Metasomal segments I–IV, pigment pattern; C. Metasomal segment V, male, dorsal aspect, and Androvestigia; D. Metasomal segment V, male, ventral aspect; E–H. *Brachistosternus negrei*; E. Tergites IV and V, pigment pattern; F. Metasomal segments I–IV, pigment pattern; G. Metasomal segment V, male, dorsal aspect and Androvestigia; H. Metasomal segment V, male, ventral aspect. Scale bars: 1 mm.

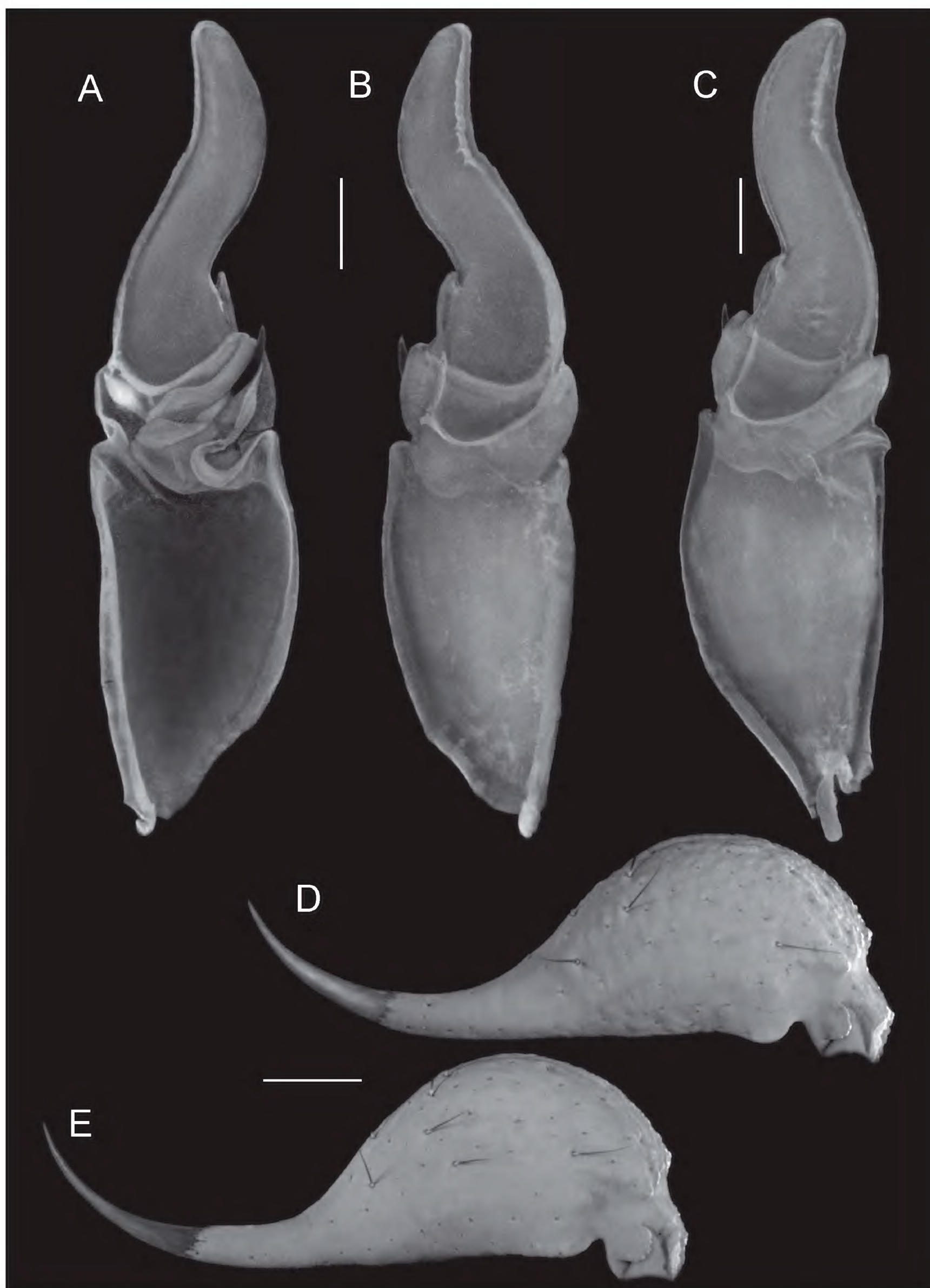


Figure 6. A, B, D–E. *Brachistosternus pehuenche* sp. nov. **A.** Left hemispermatophore, internal aspect; **B.** Left hemispermatophore, external aspect; **D.** Telson male, lateral aspect; **E.** Telson female, lateral aspect; **C.** *Brachistosternus negrei* left hemispermatophore, external aspect. Scale bars: 1 mm.

Metasoma: Metasomal segment I, dorsal surface barely granular, median sulcus well developed and smooth; DL carinae well developed, granular, extending only on the posterior half of the segment, with a DL macrosetae; lateral surface granular between LM and DL carinae, the

rest smooth; LM carinae granular, restricted to the posterior half of the segment, with a medial seta; granular LIM carinae present in the posterior half of the segment, with a seta near the posterior margin; ventral surface smooth in females, densely granular in males, without VL cari-

nae, with two VL macrosetae on each side (in smooth pits in males), and with two VL and two VSM macrosetae in the posterior margin. Metasomal segments II and III similar to segment I, but less granular and with less developed carinae, ventrally with one or two pairs of VSM setae. Metasomal segment IV, dorsal surface smooth, DL carinae granular, occupying almost the entire length of the segment, with a DL median macroseta and a posterior accessory dorsal carina; lateral margins granular, more so in males, with three LSM setae, ventrally smooth, with abundant scattered macrosetae. Metasomal segment V, elongated (Fig. 5C, D); length/width ratio, males 1.40–1.66 (N = 10, mean = 1.58), females 1.52–1.68 in (N = 10, mean = 1.61); dorsal surface smooth, Androvestigia of males conspicuous, occupying about a third of the dorsal surface of the segment (Fig. 5C), without a conspicuous DL carinae, reduced to some scattered granules in males, and three DL setae on each side, lateral margins granular in males, smooth in females, LSM carinae reduced to a row of eight or nine setae, ventral surface densely granular in posterior three quarters, more so in males, VL carinae well developed, granular and extending almost the entire length of the segment, VM carina barely visible, represented by a more granular median area, more visible in the posterior half of the segment (Fig. 5D), with 9–12 VL macrosetae (N = 15; Median = 9), and abundant ventral macrosetae, usually arranged in four transversal rows, one near the anterior margin of four macrosetae, one in the anterior third of two macrosetae, and two or three placed posteriorly, of one or two macrosetae each (usually two), being the more common distribution 4-2-2-2 or 4-2-2-2-2.

Telson: Vesicle globose, slightly more so in males, surface slightly granular in antero-ventral margin, the rest smooth; ventrally with two VSM shallow furrows, laterally with a longitudinal wide smooth furrow; males with two barely visible dorsal glandular areas which occupy most of the dorsal margin. Aculeus longer than the vesicle, shallowly curved, more so in females (Fig. 6D, E).

Hemispermaphore: Basal portion (stem) well developed. Distal lamina (stalk) well developed, slightly curved medially (Fig. 6A, B), similar in length or slightly longer to the basal portion (Fig. 6B), usually ending in a relatively acute tip; distal lobe or distal posterior flexure (distal carinae) medium-sized, occupying less than a quarter of the distal lamina; distal crest medium-sized, extending about a third of the distal lamina, with several small transverse crests and placed very close to the posterior margin. Lobe region (capsule) complex; basal lobe (basal carina) with several folds and lobes exclusive to genus *Brachistosternus*: left hemispermaphore: cylindrical apophysis of the basal lobe well developed (Fig. 6A), of a similar thickness in most of its length and with its tip barely reaching the base of the distal lobe (distal carina), slightly longer than the laminar apophysis; laminar apophysis bilobed, with a median internal longitudinal flexure that divides it into two lobes; (subex), row of spines very well developed, usually protruding over a small cuticular base; basal spines

well developed and continuing the row of spines, internal spines absent; basal triangle medium-sized, formed by three chitinous crests. Right hemispermaphore similar to left hemispermaphore but without a cylindrical apophysis; instead, there is a medium-sized internal laminar apophysis (ILA) (Ojanguren-Affilastro et al. 2018), poorly chitinized, with spines in its dorsal and external margins, apical spines of the row of spines longer than basal ones.

Distribution. *Brachistosternus pehuenche* is currently known only from the upper basin of the Maule Valley, located in the Maule Region of central Chile. This region lies within the Andean Maule forests, characterized by a complex landscape of valleys and mountain ranges ranging from approximately 1000 to 1800 m a.s.l. The scorpion has been collected in a variety of microhabitats within this elevation range, including shrub steppes, gramineous steppes, and dry woodlands, but it appears to be more abundant in open environments like shrub and gramineous steppes.

The distribution of *B. pehuenche* appears to be tightly restricted to the upper Maule Valley, as no specimens have been found in adjacent areas despite extensive fieldwork performed by our group in the different seasons of the year (see below). For example, surveys conducted in the Altos del Lircay Reserve to the north and the Pejerrey area to the south failed to detect the species, further supporting the hypothesis of its endemism to the Maule Valley. Instead, *B. negrei*, a closely related species, dominates in these neighboring regions, underscoring the geographic and ecological isolation of *B. pehuenche*.

Ecology. *Brachistosternus pehuenche* inhabits the distinctive landscape of the Andes Maulinos Botanical Formation, which represents the southernmost boundary of high Andean steppes. This region is characterized by a unique combination of dry woods, shrub steppes, and gramineous steppes, with plant species such as *Chuquiraga oppositifolia*, *Gochnatia foliosa*, *Proustia cuneifolia* (Asteraceae), *Discaria articulata* (Rhamnaceae), and *Festuca acanthophylla* (Poaceae). These diverse habitats not only host the scorpion but also shape a mosaic critical to its survival.

Interestingly, *B. pehuenche* has demonstrated ecological flexibility by thriving across these environments, with a marked preference for shrub and gramineous steppes over wooded areas. Its seasonal activity pattern occurs in spring and summer, a period shared with *U. trewanke* but not *U. pehuenche*, which remains active during winter. This temporal niche differentiation may reduce direct competition among sympatric scorpion species in the region.

Field studies also suggest that *B. pehuenche* contributes significantly to the local arthropod trophic web during its active months due to its abundance, being one of the most common predators among epigeal arthropods. However, winter surveys have consistently failed to locate active specimens, indicating a strict period of dormancy. This activity pattern aligns with ecological pressures such as temperature extremes and resource availability, common in high-altitude Andean ecosystems.

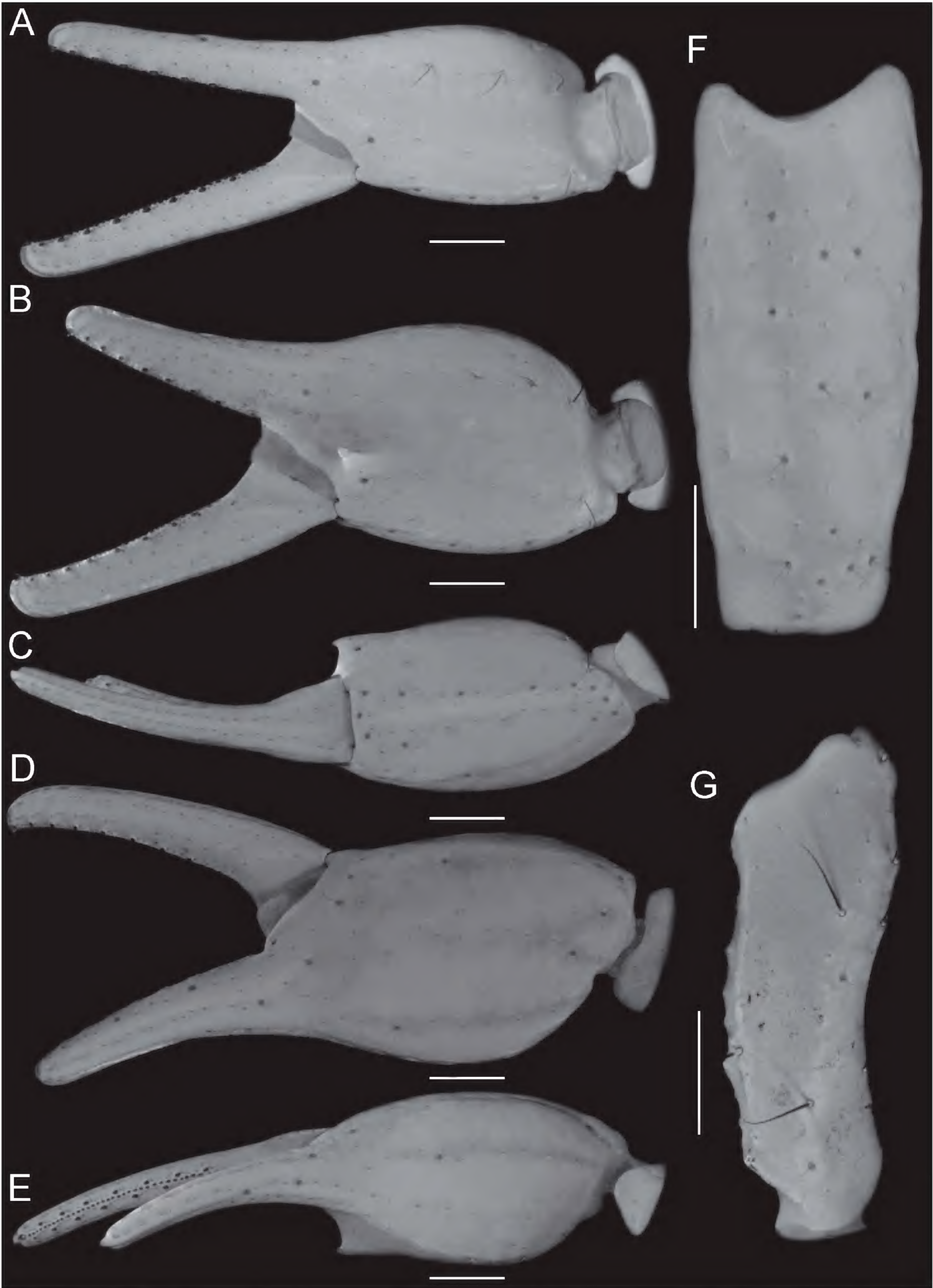


Figure 7. A–G. *Brachistosternus pehuenche* sp. nov. **A.** Right pedipalp chela, female, internal aspect; **B.** Right pedipalp chela, male, internal aspect; **C.** Right pedipalp chela, male, ventral aspect; **D.** Right pedipalp chela, male, external aspect; **E.** Right pedipalp chela, male, dorsal aspect; **F.** Right pedipalp patella, male, external aspect; **G.** Right pedipalp femur, male, external aspect. Scale bars: 1 mm.

Table 1. Measurements (mm) for *Brachistosternus pehuenche* sp. nov. male and female paratypes (MACN).

	<i>Brachistosternus pehuenche</i> sp. nov.	
	Paratype ♂	Paratype ♂
Total length	45.18	46.89
Carapace, length	5.25	5.74
Carapace, anterior width	4.04	4.61
Carapace, posterior width	5.66	6.46
Mesosoma, total length	12.23	16.63
Metasoma, total length	27.70	26.32
Metasomal segment I, length	3.39	2.91
Metasomal segment I, width	3.64	3.88
Metasomal segment I, height	2.83	2.91
Metasomal segment II, length	4.04	3.64
Metasomal segment II, width	3.47	3.39
Metasomal segment II, height	2.75	2.91
Metasomal segment III, length	4.12	3.88
Metasomal segment III, width	3.39	3.31
Metasomal segment III, height	2.67	2.75
Metasomal segment IV, length	4.44	4.44
Metasomal segment IV, width	3.23	3.23
Metasomal segment IV, height	2.66	2.59
Metasomal segment V, length	5.25	4.85
Metasomal segment V, width	3.31	3.23
Metasomal segment V, height	2.59	2.42
Telson, length	6.38	6.30
Vesicle, width	2.51	2.51
Vesicle, height	2.02	2.18
Femur, length	4.20	3.72
Femur, width	1.13	1.37
Tibia, length	4.04	3.64
Tibia, width	1.54	1.70
Chela, length	7.67	7.11
Chela, width	2.26	1.94
Chela, height	3.67	2.34

Discussion

The restricted distribution of *B. pehuenche* emphasizes the ecological importance of the upper Maule Valley as a critical center for biodiversity and endemism in the southern Andes. This region harbors a unique combination of habitats that sustain a wealth of endemic species yet faces escalating anthropogenic pressures. Key threats include agricultural expansion, hydropower development, and the construction of international transit routes, all of which contribute to the fragmentation and degradation of its fragile ecosystems.

The discovery of *B. pehuenche* not only enhances our understanding of the biodiversity within this Andean hotspot but also underscores the pressing need for comprehensive ecological studies. Mapping the precise geographic range and identifying key microhabitats of the species are essential for understanding its ecological requirements and resilience to environmental changes. Moreover, population assessments are imperative to determine its conservation status under the IUCN criteria.

This scenario highlights the urgent necessity for implementing conservation measures aimed at preserving the up-

per Maule Valley. These efforts should include the designation of protected areas, the promotion of sustainable land-use practices, and the integration of biodiversity considerations into regional development policies. Without such actions, the long-term survival of *B. pehuenche* and other endemic taxa in this ecologically significant area remains uncertain.

The upper Maule Valley has emerged as a hotspot of endemism, with *B. pehuenche* as the latest addition to its growing list of exclusive taxa. This area’s partial geographic isolation, framed by transverse mountain chains, has facilitated the evolution of unique biota. Previous discoveries of *Alsodes pehuenche* (Cei 1976) (a frog) (Corbalán et al. 2010; Correa et al. 2018; Correa et al. 2020) and other endemic arthropods such as scorpions (Ojanguren-Affilastro et al. 2020, 2024), and at least one undescribed Myriapod and one undescribed spider (Pizarro-Araya et al. in prep.), support the hypothesis that the valley constitutes a distinct biogeographical unit.

Targeted collection campaigns have further validated this view. While neighboring regions like Altos del Lircay and Pejerrey host other *Brachistosternus* species (e.g., *B. negrei*), *B. pehuenche* appears confined to the upper Maule Valley, reinforcing its endemic status. This restricted distribution, coupled with its habitat specificity, underscores the ecological and evolutionary importance of the region.

Despite its biological significance, the upper Maule Valley faces mounting environmental threats. Intensive agricultural practices and hydropower development along the Maule River contribute to habitat degradation. Furthermore, the heavy vehicular traffic along the Pehuenche International Pass introduces additional ecological disturbances. The absence of formal protection exacerbates these risks, leaving endemic species like *B. pehuenche* vulnerable to habitat loss and population declines.

In conclusion, *B. pehuenche* exemplifies the biodiversity and endemism that make the upper Maule Valley a critical area for conservation. Its discovery not only enriches our understanding of Bothriuridae diversity but also highlights the urgent need to establish protected areas. Safeguarding this unique ecosystem would ensure the survival of its endemic species and preserve an irreplaceable component of Chile’s natural heritage.

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